POSITION PAPER FOR LINHARDT HD PRINTING

AS OF 22 July 2021

HD PRINTING AT LINHARDT: ADVANTAGES

Like hardly any other technology, the advanced HD printing technology makes it possible to achieve photo-realistic printing results that distinctly stand out from other printing technologies in terms of their brilliance and colour representation.

In addition, HD printing offers other advantages, such as taking into account sustainability aspects. Using HD-Print, labels or inking can be dispensed with and yet a visually very appealing and high-resolution print image can be realised.

The design is possible in many diameter formats (diameter 19- 50mm).

Figure 1: Sample tubes of LINHARDT HD print

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HOW THE LINHARDT HD PRINTING PROCESS WORKS

The following diagram and the following explanations are intended to give you an idea of how our HD printing works:

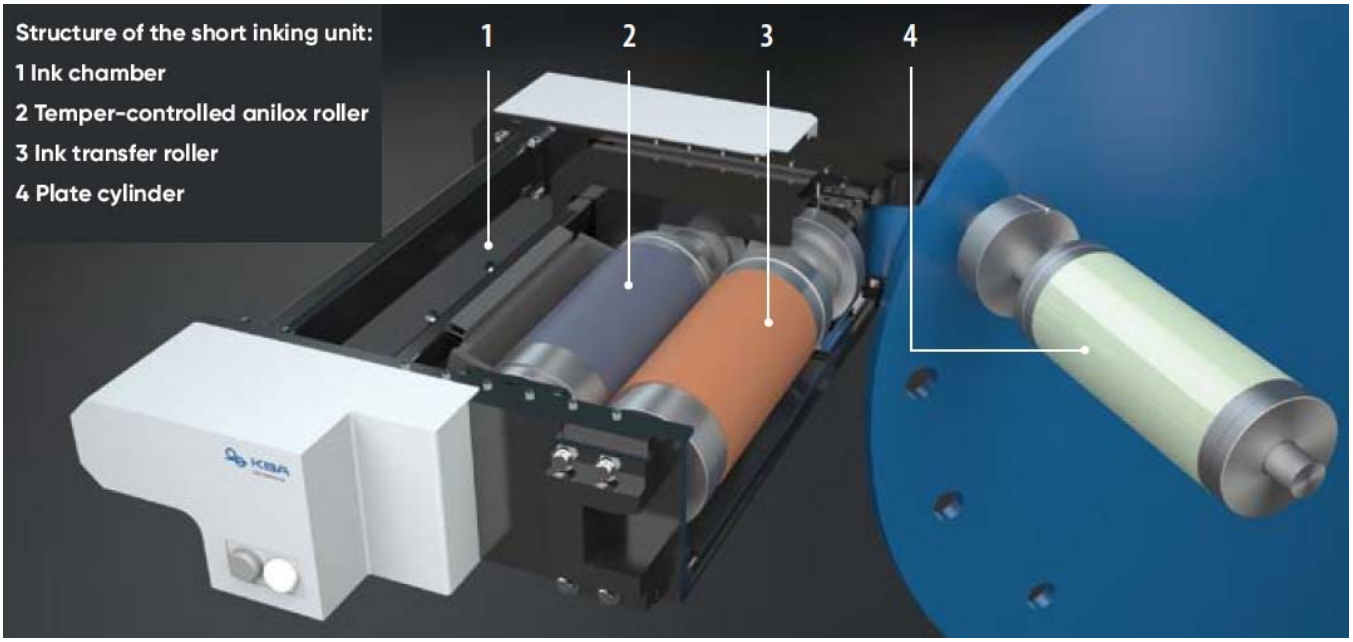

Figure 2: Structure of the short inking unit

1. The ink to be transferred is filled into the ink chamber.

2. A temperature-controlled anilox roller takes up a defined amount of ink from the ink chamber and transfers it.

3. The ink transfer roller picks up the ink from the anilox roller. It serves as a transport system and colour storage at the same time.

4. The ink is applied to the tube by means of silicone-coated printing plates. The contours that need to transfer colour, e.g. letters or graphic elements, are laser-processed. This partially dissolves the silicone layer so that the resulting indentations can absorb ink and transfer it to the tube.

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As with every printing technology, HD printing also involves technical properties, knowledge of which is important for correct print image assessment and which we would like to explain to you in the following.

DAMAGE TO PRINTING PLATES - FORMATION OF MICRO-STAINS

During the printing process, the filigree and thinly coated printing plates are exposed to external influences that may affect the quality of the subsequent printed image.

Dust and smaller particles that can adhere to the unprinted tube due to the electrostatic charge will damage the printing plates in the smallest µ range. Then, the particles are pressed into the silicone layer, creating indentations that may also absorb colour and transfer it to "unwanted" areas. On the printed tube, these damages show up as so-called micro-stains.

Figure 3: Damage to the printing plate under digital microscope (Zoom: 700x)

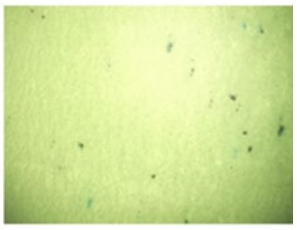

Figure 4: Resulting micro-stains under digital microscope (zoom: 100x)

Due to their very small dimensions, unfortunately detection of micro-stains is not possible even with technically advanced camera systems used for print image inspection.

The damage is irreversible, so the number of micro-stains increases as the printing press continues to run.

Cleaning the printing plates unfortunately is not possible, either, so that replacement of a printing plate is the only remedy of the situation which restores the printing result to normal.

We have already implemented many measures to avoid the damage as far as possible and thus try to limit the print image quality to an acceptable level with regard to this characteristic.

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PRINTING PLATE DAMAGE (MICRO-STAINS) WHEN USING A PCR GRANULATE

The use of a PCR (Post Consumer Recycled) granulate represents an important step towards sustainability.

Recyclate is produced by reprocessing a product that has already been put into circulation. This results in a partial contamination, which shows up in material particles within the later extruded tube. These particles increase plate damage and thus the occurrence of micro-stains in relation to the PCR content in the tube.

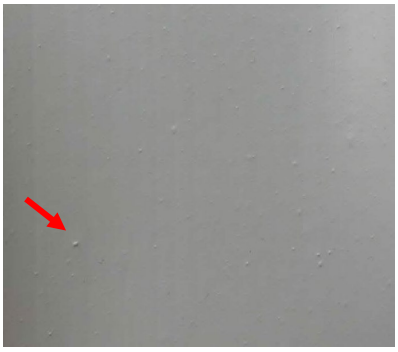

Figure 5: Inner tube wall, particle entrapments visible

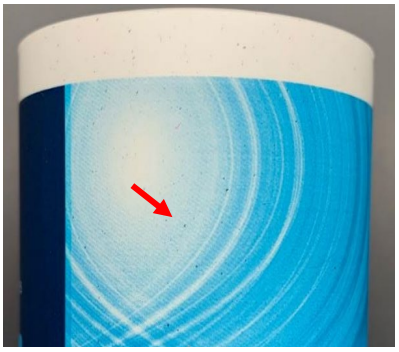

Figure 6: Print result with micro-stains

COLOUR SELECTION AND SHADE VARIATIONS:

Mixed inks are used in the offset printing process. Accordingly, the colour shades are pre-defined and can only vary in terms of brightness, depending on the setting of the printing press.

Although it is also possible to use pre-mixed special colours in HD printing in the same way as in offset printing, many print image elements are reproduced using four-colour printing, also known as 4C or CMYK printing, as standard. This process uses the colours cyan, magenta, yellow and black.

Figure 7: Example composition of an image in the CMYK system

Different shades and colours can thus be created by screenings on the plate.

In other words, the principle is similar to the interaction of the light-emitting diodes in a modern television.

Depending on the intensity of the individual colours, only certain colours are reproduced for the human eye at a further distance. The individual colours are also referred to as colour channels.

In four-colour printing, temperature fluctuations at the anilox roller and the plate cylinder may cause a fluctuation of a colour channel and thus a variation of the colour tone in all four colour directions cyan, magenta, yellow and black. Depending on the colour composition of the graphic design, slight variations may cause major visual effects:

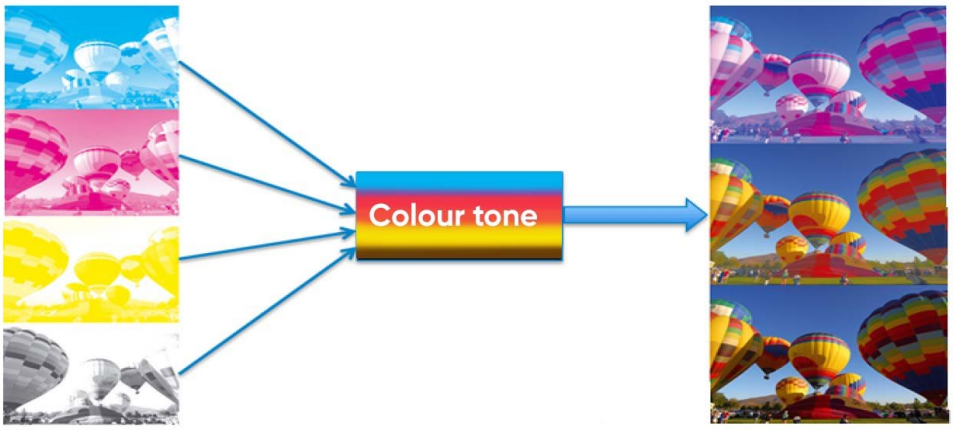

Figure 8: Example of the correlation of the colour channels (strong variation is purely for illustration purposes)

The effects of colour channel fluctuation are identical for every 4C printing technology, so flexo or digital printing are also affected by this technical condition.

Temperature fluctuations that may lead to variation are successively minimised by technical revisions and further developments of our systems. Product quality is always monitored as part of the in-process controls and regulated as necessary based on applicable customer requirements. It goes without saying that compliance with the customer's target specifications is our main focus.

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STREAK FORMATION IN SOLID PRINTING

In HD printing, less ink volume is transferred in order to be able to realise high-resolution images and to avoid squeeze marks or unwanted colour build-up. However, this may result in insufficient opacity in solid printing, so that extrusion stripes may become visible on the inside of the tube. This appearance is also influenced by the shade. Pastel shades may make the streaks stand out more, whereas colours with a higher saturation may tend to cover the streaks.

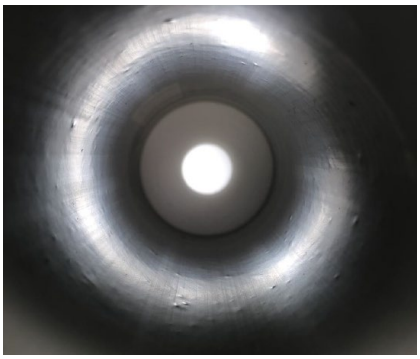

Figure 9: Tube inner wall with extrusion strip in flow direction

Figure 9: Solid printing with streaks

Thanks to our many years of experience and the production of more than 70 million tubes per year in HD printing, we ensure that the above-mentioned production factors, properties of the raw materials and the current state of the art are optimally coordinated that the characteristics shown only occur partially or are largely eliminated by in-process controls and camera systems.

However, since we cannot fully rule out individual error patterns, we want to openly deal with the topic in this position paper and strengthen our trusting customer-supplier relationship in the long term.

Therefore, if you have any questions about HD printing, please do not hesitate to contact us. Our experts are very happy to help you at any time.